WEST

Generate Collection

L8: Entry 3 of 7 File: USPT Jun 16, 1998

DOCUMENT-IDENTIFIER: US 5766510 A
TITLE: Liquid crystalline compound and use thereof

BSPR:
The present invention relates to a liquid crystalline compound and use thereof. More particularly, the present invention relates to a process for producing a novel liquid crystalline compound, which exhibits liquid crystallinity and, in addition, photoconductivity and fluorescence, and use of the liquid crystalline compound in a liquid crystalline charge transport material.

BSPR:
Materials, wherein a charge transport molecule which serves as a charge transport site are dissolved or dispersed in a matrix material, such as a polycarbonate resin, or materials, wherein a charge transport molecule structure pends as a pendant on a polymer backbone, such as polyvinyl carbazole, are known in the art. These materials have been extensively used as materials for photoconductors in copying machines, printers and the like.

BSPR:
For the above conventional charge transport materials, in the case of dispersive charge transport materials, that the charge transport molecule has high solubility in the polymer as a matrix is preferred from the viewpoint of improving the charge transport capability. In fact, however, bringing the charge transport molecule to a high concentration in the matrix leads to crystallization of the charge transport molecule in the matrix, and, for this reason, the upper limit of the concentration of the charge transport molecule is generally 20 to 50% by weight although it varies depending upon the kind of the charge transport molecule. This means that the matrix not having charge transport capability occupies not less than 50% by weight of the whole material. This in turn raises a new problem that the charge transport capability and response speed of a film formed from the material are limited by the excess matrix present in the material.

BSPR:
On the other hand, in the case of the pendant type charge transport polymer, the proportion of the pendant having charge transport capability can be increased. This polymer, however, involves many practical problems associated with mechanical strength, environmental stability and durability of the formed film, film-forming properties and the like. In this type of charge transport material, the charge transport pendants are locally located in close proximity, and the local proximity portion serves as a stable site in hopping of charges and functions as a kind of trap, unfavorably resulting in lowered charge mobility.

BSPR:
For all the above charge transport materials, electrical properties of such amorphous materials raise a problem that, unlike crystalline materials, the hopping site fluctuates in terms of space, as well as in terms of energy. For this reason, the charge transport depends greatly upon the concentration of the charge transport site, and the mobility is generally about 10.sup.-6 to 10.sup.-5 cm.sup.2 /vs which is much smaller than that of the molecular crystal, 0.1 to 1 cm.sup.2 /vs. Further, the amorphous materials have an additional problem that the charge transport properties depend greatly upon temperature and field strength. This is greatly different from the crystalline charge transport materials.

BSPR:

A polycrystalline charge transport material is a promissing material in applications where a charge transport layer having a large area is necessary, because it can form an even charge transport film having a large area can be evenly formed. The polycrystalline material, however, is inherently an uneven material from the microscopic viewpoint and involves a problem that a defect formed in the interface of particles should be inhibited.

BSPR:
Accordingly, the present invention aims to solve the above problems of the prior art and to provide a novel charge transport material which simultaneously realizes advantages of the amorphous materials, that is, structural flexibility and evenness in a large area, and advantages of the crystalline materials having molecular orientation and is excellent in high-quality charge transport capability, thin film-forming properties, various types of durability and the like.

BSPR:
Another object of the present invention is to provide a novel charge transport material which simultaneously realizes advantages of the amorphous materials, that is, structural flexibility and evenness in a large area, and advantages of the crystalline materials having molecular orientation and is excellent in high-quality charge transport capability, thin film-forming properties, various types of durability and the like.

BSPR:
According to a yet further aspect of the present invention, there is provided a liquid crystalline charge transport material which exhibits smectic liquid crystallinity and has a reduction potential relative to a standard reference electrode (SCE) in the range of from -0.3 to -0.6 (Vvs. SEC).

BSPR:
According to a yet further aspect of the present invention, there is provided a liquid crystalline charge transport material which exhibits smectic liquid crystallinity and has an oxidation potential relative to a standard reference electrode (SCE) in the range of from 0.2 to 1.3 (Vvs. SEC).

DRPR:
FIGS. 1, 2, 3 and 4 are cross-sectional views of embodiments where the crystalline charge transport material according to the present invention has been applied to a charge transport layer in an image recording device;

DRPR:
FIG. 5 is a cross-sectional view of an embodiment where the liquid crystalline charge transport material has been applied to a space light modulating device; and

DRPR:
FIG. 6 is a cross-sectional view of an embodiment where the liquid crystalline charge transport material according to the present invention has been applied to a thin film transistor.

DEPR:
The present invention provides a novel liquid crystalline compound which exhibits liquid crystallinity and, in addition, photoconductivity and fluorescence. The novel liquid crystalline compound is useful as a material for a liquid crystal display, a photosensitive material for electrophotography and the like. In particular, the liquid crystalline compound of the present invention has strong fluorescence and, hence, when used as a material for a color liquid crystal display or used in combination with a dichroic dye, can effectively utilize an ultraviolet portion in a backlight source, offering a display image having excellent sharpness and brightness.

DEPR:
According to a further aspect of the present invention, there is provided a liquid crystalline charge transport material which exhibits smectic liquid crystallinity and has a reduction potential relative to a standard reference electrode (SCE) in the range of from -0.3 to -0.6 (Vvs. SEC). According to a further aspect of the present invention, there is provided a liquid crystalline charge transport material which exhibits smectic liquid crystallinity and has an

oxidation potential relative to a standard reference electrode (SCE) in the range of from 0.2 to 1.3 (Vvs. SEC).

DEPR:
A liquid crystalline molecule, by virtue of its molecular structure, has self-orientation, and, in the case of charge transport utilizing this molecule as a hopping site, unlike the above molecule dispersive material, the spacial and energy scattering of the hopping site is inhibited, enabling a band-like transport property such as found in a molecular crystal to be realized. This enables a mobility of about 10.sup.-3 to 10.sup.-2 cm.sup.2 /vs, that is, a larger mobility than that in the conventional molecular dispersive material, to be realized, and, in addition, the charge transport properties do not depend upon electric field.

DEPR:
In order that the material serves as a hole transport material, the molecule should have a low ionization potential, and, hence, the oxidation potential should be in the range of from 0.2 to 1.3 (Vvs. SEC) relative to a standard reference electrode (SCE). Further, in order that the material serves as an electron transport material, the molecule should have high electron affinity, and, hence, the reduction potential should be in the range of from -0.3 to -0.6 (Vvs.SEC). The above requirements are the same as the well known requirements for a charge transport molecule used in the conventional molecule dispersive material.

DEPR:
Preferred liquid crystalline charge transport materials of the present invention will be listed in Tables 1 to 71. Among the charge transport materials listed in these tables, more preferred materials are those which satisfy the above requirements, have (aromatic ring of 6 .pi. electron system) n (wherein n is an integer of 1 to 4) cores and exhibit smectic liquid crystallinity, those wherein the aromatic ring of 6 .pi. a electron system is linked through a carbon-carbon double bond or a carbon-carbon triple bond, and those which has a core of a benzothiazole ring, a benzoxazole ring, a benzimidazole ring, a naphthalene ring, or other aromatic ring of 10 .pi. electron system and exhibit smectic liquid crystallinity.

DEPR:
The liquid crystalline charge transport materials according to the present invention are useful for various applications such as photosensors, electroluminescence devices, photoconductors, space modulating devices, and thin film transistors.

DEPR:
The liquid crystalline charge transfer materials according to the present invention can realize high-speed mobility and inhibition of the creation of structural traps. Therefore, high-speed response photosensors may be mentioned as the first application thereof. Next, by virtue of excellent charge transport properties, the liquid crystalline charge transfer materials according to the present invention can be used as a charge transfer layer in electroluminescence devices. Further, since electric field orientation and photoconductivity can be simultaneously switched, they can be used in image display devices.

DEPR:
The application to image display devices will be described as a representative example. In an image display device, when a device comprising a transparent substrate, such as glass, a transparent electrode, such as ITO (indium-tin-oxide), a charge generating layer capable of generating carriers according to exposure, the liquid crystalline charge transport material of the present invention, and a counter electrode (such as a gold electrode) laminated in that order is subjected to imagewise exposure (input image) through the bottom of the device as shown in the schematic diagram, the liquid crystalline charge transport material is aligned according to the exposure, resulting in flow of carriers in the counter electrode (gold electrode). The input image can be reproduced by optical reading of the alignment of the liquid crystal. The larger the smectic properties of the liquid crystal, the longer the storage time of the alignment of the liquid crystal and the longer the storage time of the input information.

DEPR:
FIGS. 1 to 3 are explanatory diagrams of embodiments where the liquid crystalline charge transport material according to the present invention has been applied to a charge transport layer in an image recording device. FIG. 1 is a schematic view of a photosensor, an embodiment where the liquid crystalline charge transport material according to the present invention has been applied to a charge transport layer. Use of the photosensor will be described in more detail. As shown in FIG. 3, the device is subjected to pattern exposure from the direction of the above in the drawing while applying a voltage across the upper and lower electrodes 15. Carriers are generated in a pattern form in 14', and charges transported by a charge transport layer 14" are discharged in a space 19 and reach the surface of an information recording layer 11.

DEPR:
In the embodiment shown in FIG. 4, exposure with a voltage being applied may be carried out in the same manner as described above in connection with the embodiment shown in FIG. 3. The generated charges (image) are accumulated on the top surface of a dielectric layer 20, and the liquid crystal is aligned in a pattern form in an electric field of charges accumulated in the same manner as described above in connection with the embodiment shown in FIG. 3 and accumulated, enabling optical reading to be performed.

DEPR:
Further, the liquid crystalline charge transport material according to the present invention can be used also in a pace optical light modulating device schematically shown in FIG. 5. Furthermore, the liquid crystalline charge transport materials of the present invention can also be used as an active layer of a thin film transistor. For example, as shown in FIG. 6, the liquid crystalline material may be disposed on a substrate having thereon source, drain, and gate electrodes.

DEPR:
Thus, the liquid crystalline charge transport materials according to the present invention are useful for various applications such as photosensors, electroluminescence devices, photoconductors, space modulating devices, and thin film transistors.

DEPL:
Liquid crystalline charge transport material

WEST

Help | Logout | Interrupt

Main Menu | Search Form | Posting Counts | Show S Numbers | Edit S Numbers | Preferences

Search Results -

Term	Documents
SPACE.DWPI,TDBD,EPAB,JPAB,USPT.	1606488
SPACES.DWPI,TDBD,EPAB,JPAB,USPT.	253664
LIGHT.DWPI,TDBD,EPAB,JPAB,USPT.	2027035
LIGHTS.DWPI,TDBD,EPAB,JPAB,USPT.	97552
MODULATING.DWPI,TDBD,EPAB,JPAB,USPT.	98998
MODULATINGS.DWPI,TDBD,EPAB,JPAB,USPT.	1
IMAGE.DWPI,TDBD,EPAB,JPAB,USPT.	1830367
IMAGES.DWPI,TDBD,EPAB,JPAB,USPT.	342919
PHOTOCONDUCTOR.DWPI,TDBD,EPAB,JPAB,USPT.	21198
PHOTOCONDUCTORS.DWPI,TDBD,EPAB,JPAB,USPT.	5109
(L6 AND (SPACE LIGHT MODULATING AND IMAGE AND PHOTOCONDUCTOR AND FILM TRANSISTOR) AND THIN FILM).USPT,JPAB,EPAB,DWPI,TDBD.	7

There are more results than shown above. Click here to view the entire set.

Database:

US Patents Full-Text Database
US Pre-Grant Publication Full-Text Database
JPO Abstracts Database
EPO Abstracts Database
Derwent World Patents Index
IBM Technical Disclosure Bulletins

Refine Search:

```
l6 and (space light modulating and image
and photoconductor and film transistor)
and thin film
```

Clear

Search History

Today's Date: 11/8/2001

DB Name	**Query**	**Hit Count**	**Set Name**
USPT,JPAB,EPAB,DWPI,TDBD	l6 and (space light modulating and image and photoconductor and film transistor) and thin film	7	L8
USPT,JPAB,EPAB,DWPI,TDBD	l6 and space light modulating and image and photoconductor or film transistor and thin film	28369	L7
USPT,JPAB,EPAB,DWPI,TDBD	charge transport	9539	L6
USPT,JPAB,EPAB,DWPI,TDBD	l1 and thin film	0	L5
USPT,JPAB,EPAB,DWPI,TDBD	l1 and snesor	0	L4
USPT,JPAB,EPAB,DWPI,TDBD	l1 and space	1	L3
USPT,JPAB,EPAB,DWPI,TDBD	l1 and electroluminescence	0	L2
USPT,JPAB,EPAB,DWPI,TDBD	EP-518636-$.did. or US-5072021-$.did. or JP-62010045-$.did.	7	L1